

Proposal Reviews

#217: Monitoring pesticide use in Sacramento watershed and estimating pesticide residues flowing into the river system using GIS and environmental modeling

University of California, Davis, Department of Land, Air, and Water Resources

Research and Restoration Technical Panel Review

Bay Regional Review

Delta Regional Review

Sacramento Regional Review

External Scientific Review

#1

#2

#3

Environmental Compliance

Budget

Research and Restoration Technical Panel Review:

CALFED Bay-Delta 2002 ERP PSP Research and Restoration Technical Panel Review Form

Proposal Number: 217

Applicant Organization: University of California, Davis, Department of Land, Air, and Water Resources

Proposal Title: Monitoring pesticide use in Sacramento watershed and estimating pesticide residues flowing into the river system using GIS and environmental modeling

Review:

Please provide an overall evaluation summary rating:

Superior: outstanding in all respects;

Above Average: Quality proposal, medium or high regional value, and no significant administrative concerns;

Adequate: No serious deficiencies, no significant regional impediments, and no significant administrative concerns;

Not Recommended: Serious deficiencies, significant regional impediments or significant administrative concerns.

Overall Evaluation Summary Rating	Provide a brief explanation of your summary rating
-Superior	The GIS maps of pesticide usage that the project will generate could be worthy of funding in their own right. However, the true key to overall success of this project lies in the ability to effectively predict fate and transport of pesticides in the field. A lack of information on model calibration, lack of field validation, an absence of information on how the exposure predictions will be related to effects so that a risk assessment could be conducted are serious flaws in the proposal.
-Above average	
-Adequate	
XNot recommended	The panel notes that enough information is available from other sources (e.g., USGS) to allow retrospective validation of the modeling predictions to be conducted.

1. **Goals and Justification.** Does the proposal present a clear statement of goals, objectives and hypotheses? Does the proposal present a clear justification and conceptual model for the project?

The applicants claim to test the hypothesis that high use of toxic pesticides in the region contaminates surface water quality, which in turn affects the riparian habitats for fish and other water-dependent species, and hence ultimately threatens the ecosystem sustainability of the Sacramento River system. The project actually only tests whether pesticides are likely to contaminate surface water quality.

2. **Likelihood of Success (Approach, Feasibility, Capabilities and Performance Measures).** Is the project likely to succeed based on the approach, feasibility and project team capabilities? Are the proposed performance measures adequate for measuring the project's success?

The approach contains two main components: 1) using GIS and the pesticide use report (PUR) database they will monitor and analyze spatial variation of pesticide use in the entire Sacramento River basin and its dynamics in recent years. 2) Combining environmental modeling into the framework of GIS they intend to quantitatively estimate the amount of pesticide residues entering the waterways of the river system and the pesticide residual concentration in each segment of the river system.

It is very difficult to tell whether the modeling approach is appropriate because no details were provided on the model(s) to be used, and indeed it appears that the applicants have not yet firmly decided which model(s) they will use. Likewise there is no information about if/how the model parameters and predictions will be validated (but see point 4 under data management they suggest that it will be validated but nothing on how or what criteria will be considered). The authors refer to a number of models and on p. 7 point out shortcomings and intensive data requirements of them it is not clear how this could affect the projects feasibility.

Though the combination of GIS and PUR is attractive and could provide very useful information, the approach as described does not fulfill the objectives. In particular it is stated in numerous places that the information will be used to perform a risk assessment. However, the only information provided is on exposure and there is no indication as to how this could be combined with relevant effects data to estimate risk. Likewise a description of how the model will be calibrated and its predictions validated in the field is entirely lacking.

With regard to capabilities it was suggested that there is a need to include an experienced hydrologic systems modeler as part of the team.

3. **Outcomes and Products.** Will the project advance the state of scientific knowledge in general and/or make an important contribution to the state of knowledge of the Bay-Delta Watershed? For restoration proposals, is the project likely to contribute to ecosystem restoration or species recoveries in a significant way? Will the project produce products useful to decision-makers and scientists?

If the model predictions can be validated a spatial map of pesticide use intensity and input pathways and loadings would be potentially very useful to decision-makers.

4. **Cost/Benefit Comments.** Is the budget reasonable and adequate for the work proposed?

This 2 year project has a total budget of \$329,041. The salary of \$40 K for a Ph.D. student was questioned as was the need for funding to international conferences.

5. **Regional Review.** How did the regional panel(s) rank the proposal (High, Medium, Low)? Did the regional panel(s) identify significant benefits (regional priorities, linkages with other activities, local involvement) or impediments (local constraints, conflicts with other activities, lack of local involvement) to this proposal? What were they?

Bay Regional Review ranked the project medium. They considered it useful but of limited applicability to the Bay region.

Delta Regional Review ranked the project as low because the project lacks real-time data or n-site BMPs implementation along with program or regulatory attention to result in reductions in toxicity from pesticides. No involvement of stakeholder groups or agricultural commissioners, farming groups or regulatory agencies.

Sacramento Regional Review ranked the project low because it has no field verification phase and does not seem to be well linked to any other activity in the watershed. Provides an after-the-fact look at the river system and may not be useful for predicting future pesticide loads. They noted a letter of support from USEPA but none from the local agricultural community.

6. **Administrative Review.** Were there significant concerns about the proposal with regard to the prior performance, environmental compliance and budget administrative reviews? What were they?

Re. Environmental compliance no issues.

Re. Budget Project manager costs not considered; proposed amount used Federal overhead rate.

Miscellaneous comments:

None

Bay Regional Review:

Proposal Number: 217

Applicant Organization: University of California, Davis, Department of Land, Air, and Water Resources

Proposal Title: Monitoring pesticide use in Sacramento watershed and estimating pesticide residues flowing into the river system using GIS and environmental modeling

Overall Ranking: -Low **XMedium** -High

Provide a brief summary explanation of the committee's ranking:

The panel felt that this research using existing PUR data appeared feasible and could be useful for pointing to pesticide hot spots in the Sacramento region. However, the proposal had limited applicability to the Bay region.

1. Is the project feasible based on local constraints?

-Yes **XNo**

How?

N/A. the project is very likely feasible for the area in question; however, it is not dependent on bay area regional constraints as it does not cover this area.

2. Does the project pursue the restoration priorities applicable to the region as outlined in the PSP?

-Yes **XNo**

How?

N/A. Not relative to the Bay area except in that pesticide residues could travel through biota and in surface waters; however, the Sacramento panel should be reviewing this proposal. The proposal would likely significantly benefit to the Sacramento region.

3. Is the project adequately linked with other restoration activities in the region, such as ongoing implementation projects and regional planning efforts?

-Yes **XNo**

How?

No, very indirect as mentioned above.

4. Does the project adequately involve local people and institutions?

XYes -No

How?

The authors should be aware of the work of Kathy Kuivila of USGS who is performing similar work in other areas, SJ and Bay regions. There may be some overlap in the Sacramento region, but this needs investigating.

Other Comments:

No other comments.

Delta Regional Review:

Proposal Number: 217

Proposal Title: Monitoring pesticide use in Sacramento watershed and estimating pesticide residues flowing into the river system using GIS and environmental modeling

Overall Ranking: ☒Low ☐Medium ☐High

Provide a brief summary explanation of the committee's ranking:

The panel supports research that delivers fishery, wildlife, hydrology, and other scientific information most likely to be helpful in making decisions in the Delta.

Reductions in toxicity from pesticides would require either real-time data or on-site BMPs implementation along with program or regulatory attention. This project lacks these elements.

1. Is the project feasible based on local constraints?

☐Yes ☒No

How?

Mainly use of pesticide use database and soils data to present a model of potential toxicity in the streams. The PURs are not required to be submitted by the applicants for a few days and by the ag commissioner for a month. Typically it takes the DPR more than six months to make the data available. A real time toxicity system would require real time data transfer.

2. Does the project pursue the restoration priorities applicable to the region as outlined in the PSP?

☒Yes ☐No

How?

Goals 6 (Restore shallow water Delta habitats while minimizing contaminants' adverse effects), 4 (Restore habitat for at-risk species), 2 (Restore floodplain habitat), and 1 (Restore habitat corridors in east + north Delta + San Joaquin River) are addressed. The tools the proponent is building must fit into a larger control strategy for it to be effective. While the information could be useful, a commitment from regulatory agencies or ag commissioners to reduce pesticide runoff in identified areas would also be needed.

3. Is the project adequately linked with other restoration activities in the region, such as ongoing implementation projects and regional planning efforts?

☐Yes ☒No

How?

The project proponents dont get into it, but this ties into other pesticide studies by UCD on pesticide run off from different agricultural uses and pesticide management. This also gets into toxicity of unknown cause, for which there are other proposals.

Again, a programmatic or regulatory tie would make this type of information useful.

4. Does the project adequately involve local people and institutions?

XYes -No

How?

UCD and Sac State. But no mention of stakeholder groups or ag commissioners, farming groups, or regulatory agencies.

Other Comments:

Ambitious endeavor. Some critical steps are missing. May actually be better than trying to find the chemicals in the field, since several commercial pesticides do not have known chemical fingerprints.

Sacramento Regional Review:

Proposal Number: 217

Applicant Organization: University of California, Davis, Department of Land, Air, and Water Resources

Proposal Title: Monitoring pesticide use in Sacramento watershed and estimating pesticide residues flowing into the river system using GIS and environmental modeling

Overall Ranking: ☒Low ☐Medium ☐High

Provide a brief summary explanation of the committee's ranking:

The applicant proposes to take the existing California Department of Pesticide Regulation pesticide use report and put it into a GIS database and use this to model what might make it into the river system but it has no field verification phase to the project and does not seem to be well linked to any other activity in the watershed.

1. Is the project feasible based on local constraints?

☒Yes ☐No

How?

The first part is certainly feasible but we are less certain that the GIS database could then be used to predict anything useful. It would also be an after-the-fact look at the river system and may not be useful for predicting future pesticide loads.

2. Does the project pursue the restoration priorities applicable to the region as outlined in the PSP?

☒Yes ☐No

How?

The proposal addresses PSP Restoration priority 7 for the Sacramento region refers to both pesticides and river models.

3. Is the project adequately linked with other restoration activities in the region, such as ongoing implementation projects and regional planning efforts?

☐Yes ☒No

How?

It does not seem to be linked to any other activity in the region.

4. Does the project adequately involve local people and institutions?

-Yes XNo

How?

While they have a letter of support for this project from the US EPA they have nothing from the local agricultural community.

Other Comments:

They seem to focus on being published in peer-reviewed journals rather than ag commissioner newsletters. They need to refocus their efforts to the users in the watershed.

External Scientific: #1

Research and Restoration External Scientific Review Form

Proposal Number: **217**

Applicant Organization: **University of California, Davis, Department of Land, Air, and Water Resources**

Proposal Title: **Monitoring pesticide use in Sacramento watershed and estimating pesticide residues flowing into the river system using GIS and environmental modeling**

Conflict of Interest Statements:

I have no financial interest in this proposal.

XCorrect

-Incorrect

In the blank below please explain any connection to proposal, to applicant, co-applicant or subcontractor or to submitting institution (write "none" if no connection):

NONE

Review:

Please provide an overall evaluation summary rating:

Excellent: outstanding in all respects;

Good: quality but some deficiencies;

Poor: serious deficiencies.

Overall Evaluation Summary Rating	Provide a brief explanation of your summary rating
-Excellent	Though the combination of GIS and PUR is attractive and could provide very useful information, the approach as described does not fulfill the objectives. In particular it is stated in numerous places that the information will be used to perform a risk assessment. However, the only information provided is on exposure and there is no indication as to how this could be combined with relevant effects data to estimate risk. Likewise a description of how the predictions will be validated in the field is entirely lacking.
-Good	
X Poor	

1. **Goals.** Are the goals, objectives and hypotheses clearly stated and internally consistent? Is the concept timely and important?

The project's objective is 1) to monitor high toxic pesticides used in agricultural lands, including estimation of pesticide use intensity, pesticide loads, and pesticide residues in the fields, and 2) to model the amount of pesticide residues flowing into the river system and the pesticide concentration in the segments of the river.

The applicants claim to test the hypothesis that high use of toxic pesticides in the region contaminates surface water quality, which in turn affects the riparian habitats for fish and other water-dependent species, and hence ultimately threatens the ecosystem sustainability of the Sacramento River system. The project actually only tests whether pesticides contaminate surface water quality.

2. **Justification.** Is the study justified relative to existing knowledge? Is a conceptual model clearly stated in the proposal and does it explain the underlying basis for the proposed work? Is the selection of research, pilot or demonstration project, or a full-scale implementation project justified?

The project is clearly justified, however the conceptual model is somewhat unclear. In particular the description of the modeling is very vague.

3. **Approach.** Is the approach well designed and appropriate for meeting the objectives of the project? Are results likely to add to the base of knowledge? Is the project likely to generate novel information, methodology or approaches? Will the information ultimately be useful to decision-makers?

The approach contains two main components: 1) using GIS and the PUR database they will monitor and analyze spatial variation of pesticide use in the entire Sacramento River basin and its dynamics in recent years. 2) Combining environmental modeling into the framework of GIS they intend to quantitatively estimate the amount of pesticide residues entering the waterways of the river system and the pesticide residual concentration in each segment of the river system.

It is very difficult to tell whether the modeling approach is appropriate because no details were provided on the model(s) to be used, and indeed it appears that the applicants have not yet firmly decided which model(s) they will use.

If the model predictions can be validated a spatial map of pesticide use intensity and input pathways and loadings would be potentially very useful to decision-makers.

4. **Feasibility.** Is the approach fully documented and technically feasible? What is the likelihood of success? Is the scale of the project consistent with the objectives?

The project relies on the pesticide use report (PUR) database for California and GIS datasets. The applicants report to have access to both as well as the required software.

There is no documentation on the models that will be used and no information as to if/how the model parameters and predictions will be validated (but see point 4 under data management - they suggest that it will be validated but nothing on how or what criteria will be considered). The authors refer to a number of models and on p. 7 point out shortcomings and intensive data requirements of them - not clear how this could affect feasibility.

5. **Project-Specific Performance Measures.** Does the project include appropriate performance measures to measure success relative to the project's goals and objectives? Is there enough detail as to how the performance measures will be quantified? For restoration projects, are monitoring plans explicit and detailed enough to determine if performance measures will be adequately assessed?

The first point under project management the applicants state that one of the success criteria for the project will be obtaining the required PUR database and background datasets. Elsewhere in the proposal they indicate that they already have the database.

6. **Products.** Are products of value likely from the project? Specifically for restoration projects, are products of value also likely from the monitoring component? Are interpretative outcomes likely from the project?

Expected products include a spatial GIS database and maps showing pesticide-related indices (what are these?) affecting the water quality in the Sacramento River and the Ecosystem sustainability (no description of how they will attempt to estimate sustainability) of the Sacramento region. Also, publications and presentations will be produced.

7. **Capabilities.** What is the track record of applicants in terms of past projects? Is the project team qualified to efficiently and effectively implement the proposed project? Do they have available the infrastructure and other aspects of support necessary to accomplish the project?

The qualifications of the applicants appear adequate, though perhaps stronger on the GIS side and weaker on the ecology side.

8. **Cost/Benefit Comments.** Is the budget reasonable and adequate for the work proposed?

This 2 year project has a total budget of \$329,041. Applying for GPS and upgrade of server in equipment; rest is mostly Ph.D. and post-doc salaries.

Miscellaneous comments:

They refer to an 'ecological indicators approach' but make no attempt to describe what this approach involves.

External Scientific: #2

Research and Restoration External Scientific Review Form

Proposal Number: **217**

Applicant Organization: **University of California, Davis, Department of Land, Air, and Water Resources**

Proposal Title: **Monitoring pesticide use in Sacramento watershed and estimating pesticide residues flowing into the river system using GIS and environmental modeling**

Conflict of Interest Statements:

I have no financial interest in this proposal.

XCorrect

-Incorrect

In the blank below please explain any connection to proposal, to applicant, co-applicant or subcontractor or to submitting institution (write "none" if no connection):

none

Review:

Please provide an overall evaluation summary rating:

Excellent: outstanding in all respects;

Good: quality but some deficiencies;

Poor: serious deficiencies.

Overall Evaluation Summary Rating	Provide a brief explanation of your summary rating
-Excellent	As a GIS project designed to produce maps from distillation of a large pesticide database is warranted. This has direct management implications and would certainly be useful for the general public. The project really needs a sense of verification with fate assessment predictions, though. The PIs should link with and environmental chemist to really tie everything together on the project.
XGood	
-Poor	

1. **Goals.** Are the goals, objectives and hypotheses clearly stated and internally consistent? Is the concept timely and important?

The goals of this ambitious project are clearly presented yet not quite hypothesis driven. The PIs will attempt to glean data on pesticide use from a large database and couple that data with GIS data. This appears to be a good use for GIS and the results will be a series of maps of pesticide use and potentially, fate.

2. **Justification.** Is the study justified relative to existing knowledge? Is a conceptual model clearly stated in the proposal and does it explain the underlying basis for the proposed work? Is the selection of research, pilot or demonstration project, or a full-scale implementation project

justified?

Relative to existing knowledge, this type of study, particularly the application of GIS to reduce data in a large database to general meaningful use, is warranted. The conceptual model is presented and the proposed work is consistent with the approach. There is a definite need for this type of data reduction. The fate assessment work is somewhat tricky, though.

3. **Approach.** Is the approach well designed and appropriate for meeting the objectives of the project? Are results likely to add to the base of knowledge? Is the project likely to generate novel information, methodology or approaches? Will the information ultimately be useful to decision-makers?

This is a truly interesting project with a valid application of GIS to help translate a huge database to the point where the general public can use it and understand it. The PIs should be commended for designing such a project.

The only perceived weakness of this project, and it is perhaps a major one at that, is the total lack of groundtruthing the predictions of model simulations. One must verify the predictions of the models and this certainly won't be easy. The overlays of elevation, for one, coupled with soil type should allow for prediction of particle phase partitioning and erosion. The tricky part and one that is a concern for these types of rivers is the quantity and quality of the dissolved organic carbon content of groundwater and rivers and how contaminants partition and move downstream. These issues are critical in modeling fate assessment.

This GIS approach could certainly identify specific areas in the basin that are more susceptible to water quality degradation from pesticides. I know that classifications have been made in Wisconsin and certain sections of the state with shallow groundwaters have and low organic content soils have been identified as zones where pesticides like atrazine are banned. This would be the true value of such a database. It would be best if the current use data could be added to the database in real time to continually notify the public and make better predictions for groundtruthing.

4. **Feasibility.** Is the approach fully documented and technically feasible? What is the likelihood of success? Is the scale of the project consistent with the objectives?

This project appears to be technically feasible as written, but the true strength may be in the ability to make predictions and be able to verify them in the field. An attempt should be made in this direction to increase the likelihood of success.

5. **Project-Specific Performance Measures.** Does the project include appropriate performance measures to measure success relative to the project's goals and objectives? Is there enough detail as to how the performance measures will be quantified? For restoration projects, are monitoring plans explicit and detailed enough to determine if performance measures will be adequately assessed?

There is no specific section dealing directly with performance measures.

6. **Products.** Are products of value likely from the project? Specifically for restoration projects, are products of value also likely from the monitoring component? Are interpretative outcomes likely from the project?

The maps alone, that this project will generate, are worthy of funding. Trends can be identified and hot spots delineated. The true key to overall success of this project lies in the ability to predict fate and transport. Significant retooling of funding would be needed to achieve that goal.

7. **Capabilities.** What is the track record of applicants in terms of past projects? Is the project team qualified to efficiently and effectively implement the proposed project? Do they have available the infrastructure and other aspects of support necessary to accomplish the project?

The PIs are well qualified to conduct this research and will be able to implement the proposed work as written. Addition of an environmental chemist would definitely strengthen this project and its predictive capabilities.

8. **Cost/Benefit Comments.** Is the budget reasonable and adequate for the work proposed?

The budget appears reasonable for the type of work to be performed in the proposal. Either reprogramming or additional funding for model verification is warranted.

Miscellaneous comments:

External Scientific: #3

Research and Restoration External Scientific Review Form

Proposal Number: **217**

Applicant Organization: **University of California, Davis, Department of Land, Air, and Water Resources**

Proposal Title: **Monitoring pesticide use in Sacramento watershed and estimating pesticide residues flowing into the river system using GIS and environmental modeling**

Conflict of Interest Statements:

I have no financial interest in this proposal.

XCorrect

-Incorrect

In the blank below please explain any connection to proposal, to applicant, co-applicant or subcontractor or to submitting institution (write "none" if no connection):

I know two of the applicants, Dr. Zhang and Dr. Geng. I have no joint research with them and have not co-authored any papers.

Review:

Please provide an overall evaluation summary rating:

Excellent: outstanding in all respects;

Good: quality but some deficiencies;

Poor: serious deficiencies.

Overall Evaluation Summary Rating	Provide a brief explanation of your summary rating
-Excellent	<p>This proposal would rank higher if it was more focused not only on the type of ecosystem studied but also the spatial scale. In present form, it is very ambitious, and the chances of success in a two-year period are doubtful. It is also doubtful that the proposed model will adequately simulate the pesticide loading to tributary streams and the Sacramento River since there is no evidence presented that the model is transferrable to CA conditions and there was little detail in the proposal on how the model would be calibrated and/or validated. The part of the proposal dealing with GIS and pesticide data bases is strong.</p>
XGood	<p>The proposed research potentially could make a good contribution if one or more smaller watersheds were selected to first test, calibrate, and validate the model with measured stream loading from the smaller hydrologic unit. Then, there will be some confidence in "scaling up" to the whole Sacramento watershed. One or more hydrologists as cooperators could help with this endeavor. Being able to adequately predict pesticide loading to streams and the Sacramento River would be a major accomplishment that would allow land and pesticide management scenarios to be tested.</p>
-Poor	<p>It may also make sense to delay the risk assessment part of the study to a later proposal. Instead of attempting to do risk assessment on both aquatic and terrestrial systems, the highest priority would be to first concentrate on the aquatic ecosystem. Even for the aquatic system, the knowledge base on multiple stressor effects on the ecosystem is rudimentary at this time. It is not clear how a risk assessment would be done.</p> <p>I would recommend that the proposal be funded if the investigators would agree to decrease the scope along the line suggested above.</p>

1. **Goals.** Are the goals, objectives and hypotheses clearly stated and internally consistent? Is the concept timely and important?

The goals and objectives are generally clearly stated, although it is not clear whether the goal is to deal with the aquatic ecosystem only or whether the terrestrial ecosystem is also being considered. Overall, I believe that the goals are over ambitious in considering the whole Sacramento River watershed. This is especially so if the effects of pesticides on both the aquatic and the terrestrial ecosystems are to be considered. The goals would be more achievable if only the aquatic system was studied and probably for one sub watershed of the Sacramento River, at least to start.

2. **Justification.** Is the study justified relative to existing knowledge? Is a conceptual model clearly stated in the proposal and does it explain the underlying basis for the proposed work? Is the selection of research, pilot or demonstration project, or a full-scale implementation project justified?

The study is well-justified in terms of where the state of the knowledge is now. The conceptual model is pretty well spelled out on what needs to be done to use the pesticide data base. As stated earlier, I believe that the scale of the research, both in terms of the ecosystems to be studied and the spatial scale, is too large for a 2-yr proposal and may not be achievable..

3. **Approach.** Is the approach well designed and appropriate for meeting the objectives of the project? Are results likely to add to the base of knowledge? Is the project likely to generate novel information, methodology or approaches? Will the information ultimately be useful to decision-makers?

The approach is generally sound. Using the extensive pesticide data base for CA coupled with data on soils, land use, etc and then used in pesticide fate and transport modeling is a realistic approach to try to predict pesticide loading to the river. The main problem with the approach is lack of evidence that the pesticide fate model can adequately predict pesticide fate and transport for CA conditions with any degree of confidence. The approach would indeed greatly add to the base of knowledge and would add new methodology and approaches to learn how to scale up information to a watershed scale and learn how the aggregated results impact water quality. The research should be very useful to decision makers because it would allow predictions of how management could affect pesticide loading of the river and over what time period.

4. **Feasibility.** Is the approach fully documented and technically feasible? What is the likelihood of success? Is the scale of the project consistent with the objectives?

The pesticide data base manipulation and upscaling to the whole Sacramento watershed using GIS is technically feasible. The research that deals with using GIS in conjunction with modeling to predict the dynamics of pesticide loading to the rivers is not well documented. Also, there is little information on how the risk assessment on the aquatic ecosystem will be done. This is difficult to perform based on existing knowledge, since there are many stressors in the Sacramento River that affect the aquatic ecosystem, and it is not clearly known how these stressors interact with one another and the ultimate effect on the aquatic species in the river.

On page 5, the investigators state that the purpose of the environmental modeling is to "quantitatively estimate the amount of pesticide residues flowing into the river system that affect the water quality and threaten the sustainability of the surrounding riparian ecosystem". This is a worthy goal but is much more difficult to do than suggested by the investigators. They propose to use the SWAT model to simulate pesticide loading into the various streams feeding the Sacramento river. There is no evidence presented that SWAT has been tested, calibrated, or validated for CA conditions. These kind of models have so many assumptions and site specific requirements that they are generally not transferable to other regions without testing and calibration. A major determinant of whether this project can be successful and useful is whether the simulations of pesticide loading to the water bodies of the Sacramento watershed are in any way realistic.

Since there is no evidence that the SWAT model can even come close to adequately simulating pesticide loading to the water bodies for CA conditions, model validation and probably model calibration is needed to have any confidence that the model can adequately simulate the amount and concentration of pesticides in the tributary rivers and the Sacramento River. The model needs to be tested not only for the processes occurring on the land but also for those in the water bodies. The investigators indicate later on in the proposal (p 10 & 11) that "validation and analysis of the simulation results" will be performed, but there is no indication of how this will be done. Validation of models is usually done on a much smaller scale than a

watershed as large as the Sacramento watershed. Usually the runoff and loading from a sub watershed is first studied before trying to make the jump to the entire watershed. Simply "forcing" the model to fit the stream water quality for the entire watershed will give little confidence that it will adequately predict loading for other years and management scenarios. Getting the pesticide loading correct is critical to the next phase of the proposed research, which was to do a risk assessment to the aquatic ecosystem.

On p 9, it is proposed that the "pesticide loads and pesticide residues in the fields of the region and their spatial variation" will be monitored. This implies that measurements of loading and concentrations will be measured. How can this be realistically done for the entire Sacramento Valley?

It is not clear how the proposed risk assessment will be accomplished. This is a very complicated task since there are many more stressors than pesticides that impact the aquatic ecosystem, and there is little scientific information on how these stressors interact. It is not even clear how pesticides affect the aquatic ecosystem.

5. **Project-Specific Performance Measures.** Does the project include appropriate performance measures to measure success relative to the project's goals and objectives? Is there enough detail as to how the performance measures will be quantified? For restoration projects, are monitoring plans explicit and detailed enough to determine if performance measures will be adequately assessed?

There are some performance measures identified such as comparing measured pesticide loading to streams with model output, but there is not enough detail given to know how this can be adequately quantified. Monitoring of pesticide loading and pesticide residues in fields is planned, but the scope and intensity of the monitoring is not defined clearly enough to judge its usefulness.

6. **Products.** Are products of value likely from the project? Specifically for restoration projects, are products of value also likely from the monitoring component? Are interpretative outcomes likely from the project?

One potential product of the research would be simulation tools (models) capable of adequately simulating pesticide loading to tributaries and the main river in the Sacramento Valley. Such a product if adequately validated would provide a powerful tool in predicting how land use and pesticide use changes may have on the aquatic ecosystems.

7. **Capabilities.** What is the track record of applicants in terms of past projects? Is the project team qualified to efficiently and effectively implement the proposed project? Do they have available the infrastructure and other aspects of support necessary to accomplish the project?

The investigators are experts in GIS, remote sensing, and agricultural ecosystems. I believe that the project would have benefited greatly by having an outstanding and experienced hydrologic systems modeler as part of the team. In my view, the weakest part of the proposal is the ability to adequately predict runoff, pesticide loading of streams, and fate of the pesticides in the water bodies, because as far as I can tell, the model is untested for CA conditions. With strong programs in hydrology and water resources engineering at UCD, there must be someone that could assist on the hydrology aspects.

8. **Cost/Benefit Comments.** Is the budget reasonable and adequate for the work proposed?

In my judgement, the scope of the proposed research is so overly ambitious that I doubt it could be accomplished within two years with a budget many times larger than requested.

I note in terms of salaries under budget justification that the salary of a student is nearly \$40K per year. Is this correct? Why is travel needed for international conferences?

Miscellaneous comments:

Environmental Compliance:

Proposal Number: 217

Applicant Organization: University of California, Davis, Department of Land, Air, and Water Resources

Proposal Title: Monitoring pesticide use in Sacramento watershed and estimating pesticide residues flowing into the river system using GIS and environmental modeling

1. Are the legal or regulatory issues that affect the proposal identified adequately in the proposal?

☒Yes ☐No

If no, please explain:

2. Does the project's timeline and budget reflect adequate planning to address legal and regulatory issues that affect the proposal?

☒Yes ☐No

If no, please explain:

3. Do the legal and regulatory issues that affect the proposal significantly impair the project's feasibility?

☐Yes ☒No

If yes, please explain:

Other Comments:

Budget:

Proposal Number: 217

Applicant Organization: University of California, Davis, Department of Land, Air, and Water Resources

Proposal Title: Monitoring pesticide use in Sacramento watershed and estimating pesticide residues flowing into the river system using GIS and environmental modeling

1. Does the proposal include a detailed budget for each year of requested support?

☒Yes -No

If no, please explain:

2. Does the proposal include a detailed budget for each task identified?

☒Yes -No

If no, please explain:

3. Does the proposal clearly state the type of expenses encompassed in indirect rates or overhead costs?

☒Yes -No

If no, please explain:

4. Are appropriate project management costs clearly identified?

-Yes ☒No

If no, please explain:

Project Manager not considered as to costs.

5. Do the total funds requested (Form I, Question 17A) equal the combined total annual costs in the budget summary?

☒Yes -No

If no, please explain (for example, are costs to be reimbursed by cost share funds included in the budget summary).

6. Does the budget justification adequately explain major expenses?

☒Yes -No

If no, please explain:

7. Are there other budget issues that warrant consideration?

☒Yes ☐No

If yes, please explain:

Proposed amount used Federal overhead rate.

Other Comments: